

Loss Prevention Standard

LPS 1223: Issue 2.3

Requirements and testing procedures for the LPCB certification and listing of fixed fire extinguishing systems for catering equipment

This document specifies the requirements and test procedures for LPCB Approval of fixed fire extinguishing systems designed for the protection of catering equipment, such as deep fat fryers, other cooking appliances and extract systems.

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PARTICIPATING ORGANISATIONS

This standard was prepared by Expert Groups B & C and approved by the LPC (Fire and Security) Board of BRE Global Ltd.

The following organisations participated in the preparation of this standard:-

Association of British Insurers / Lloyd's
 Association of Building Engineers
 Association of Chief Police Officers
 Association for Specialist Fire Protection
 BRE Global
 British Automatic Fire Sprinkler Association
 British Fire Protection Systems Association
 British Security Industry Association
 BT Redcare
 Confederation of British Industry
 European Fire Sprinkler Network
 Chief Fire Officers' Association
 Door and Hardware Federation
 Electrical Contractors Association
 Health and Safety Executive
 RISC Authority
 International Fire Sprinkler Association
 MetroNet
 National Fire Sprinkler Association
 Risk Engineering Data Exchange Group
 Royal and Sun Alliance
 Royal Institution of Chartered Surveyors
 The Fire Protection Association

REVISION OF LOSS PREVENTION STANDARDS

Loss Prevention Standards will be revised by issue of revised editions or amendments. Details will be posted on our website at www.redbooklive.com

Technical or other changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments. (See amendments table on page 19)

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

USERS OF LOSS PREVENTION STANDARDS SHOULD ENSURE THAT THEY POSSESS THE LATEST ISSUE AND ALL AMENDMENTS.

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FOREWORD

This standard identifies the evaluation and testing practices undertaken by LPCB for the purposes of approval and listing of products. LPCB listing and approval of products and services is based on evidence acceptable to LPCB:-

- that the product or service meets the standard
- that the manufacturer or service provider has staff, processes and systems in place to ensure that the product or service delivered meets the standard

and on:-

- periodic audits of the manufacturer or service provider including testing as appropriate
- compliance with the contract for LPCB listing and approval including agreement to rectify faults as appropriate

NOTES

Compliance with this LPS does not of itself confer immunity from legal obligations. Users of LPSs should ensure that they possess the latest issue and all amendments.

LPCB welcomes comments of a technical or editorial nature and these should be addressed to “the Technical Director” at enquiries@breglobal.co.uk.

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Listed products and services appear in the LPCB “List of Approved Products and Services” which may be viewed on our website: www.redbooklive.com or by downloading the LPCB Red Book App from the App Store (for iPhone and iPad), from Google Play (for Android devices) or from the Windows Store (for Windows 8 Phones and Tablets from 2014).

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1 SCOPE

This document specifies the requirements and test procedures for LPCB Approval of fixed fire extinguishing systems designed for the protection of catering equipment, such as deep fat fryers, other cooking appliances and extract systems.

The objective of the approval procedure is to evaluate the effectiveness and reliability of a system in extinguishing fires in catering equipment, initiated in the cooking appliance. The evaluation of a system is essentially a verification of the parameters specified in the system manual.

The requirements and test procedures specified herein are those which generally enable a satisfactory evaluation of a system to be made. However, the LPCB reserves the right to apply special considerations dependant on the scope of application of a particular system if it is not adequately dealt with by this standard.

2 DEFINITIONS

2.1 Catering equipment

Cooking appliances together with any associated extract system

2.2 Cooking appliances

Appliances that are not completely enclosed and may have an open surface of cooking fat, e.g. deep fat fryers, griddles, broilers etc. Ovens, water boilers etc. are not included.

2.3 Discharge Time

Duration of agent discharge.

2.4 Extract ductwork

A duct for removing cooking vapours from the extract hood to the open generally with the assistance of an extract fan.

2.5 Extract hood

A canopy provided above cooking appliances to collect the fat-laden vapours and exhaust gases and transfer them to the extract ductwork.

2.6 Extract system

The extract hood and ductwork with associated filters and extract fan

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2.7 Fat

For the purposes of this document the term 'fat' also includes cooking oils.

2.8 Plenum

The space enclosed by the hood above the filters

2.9 System manual

A document or documents provided by the system manufacturer giving full instructions on the design, installation, operation, recharging and maintenance of the system.

3 REQUIREMENTS

3.1 Design requirements

- 3.1.1 The fixed fire extinguishing system (hereafter referred to as “the system”) shall protect the extract system, where present, and all of the cooking appliances served by it.
- 3.1.2 The system shall be capable of both automatic actuation by a detection system and manual actuation at a manual release point.
- 3.1.3 The detection system shall be capable of detecting fires initiated in any of the cooking appliances and within the extract hood (where present).
- 3.1.4 The manual release point shall be sited in a prominent position near to the catering equipment being protected but shall not be so close as to be inaccessible in the event of a fire in the equipment. In general, the manual release point should be sited on the way to the nearest fire exit from the protected equipment.
- 3.1.5 The system shall also be capable of causing shut-down of the catering equipment heat source upon manual actuation or operation of the detection system.
- 3.1.6 It shall not be possible for the user to isolate any electrical power supply to the system without also isolating the power and any fuel or power supplies to the catering equipment heat source.
- 3.1.7 The system shall be supplied with labels for fixing to the catering equipment, stating that the catering equipment must not be operated whilst the extinguishing system is out of commission.
- 3.1.8 The system's discharge nozzles shall be protected against ingress of fat deposits.

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- 3.1.9 Where the system may employ more than one agent container, system actuation shall simultaneously release the agent from all containers.
- 3.1.10 The system shall be capable of connection to a fire-bell or other alarm. The provision of an alarm which sounds in the event of system operation is recommended.
- 3.1.11 For pumped systems, it shall be possible for periodic pump and flow tests to be conducted, as specified by the manufacturer.
- 3.1.12 For pumped systems, power supply to the suppression system should be from a dedicated electrical feed circuit, provided with it's own RCD protection and feeding no other appliances.
- 3.1.13 For pumped systems, the installation manual shall specify at least the following requirement. Maximum and minimum supply pressures and flow rates of the water source are to be determined. With respect to these figures the limits of the system shall be stated.

3.2 System manual requirements

- 3.2.1 For the system manual to be acceptable as part of a system submitted for approval, it shall contain full instructions for the design, installation, operation, recharge and maintenance of the system. In particular, the following shall be included:-

Full descriptions and operating details of each system component and all accessory equipment.

The limitations that are placed on system design i.e. the types, numbers and dimensions of catering equipment that may be protected;

For stored pressure/gas cartridge type systems the maximum number of agent containers that can be linked in one system;

For pumped systems, the minimum flow and water supply pressure; the types, numbers and placement of discharge nozzles required for the various items of catering equipment; the type, cross-sectional dimensions and lengths of agent distribution pipework and the numbers of tees and bends that are permitted or the limitations placed on the pipework and fittings in terms of equivalent length of pipe, or maximum numbers; and, the types, numbers and placement of detectors used in the detection system.

- 3.2.2 Further, in addition to the features required by Section 3.1 Design requirements, the system manual shall adequately describe the following;

Where the products of combustion of gas-heated cooking appliances are introduced into the extract ductwork, the special provisions required for the detection systems.

Whether or not it is required that the extract fan be shutdown upon system actuation.

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3.3 Authorised installer requirements

The applicant shall have procedures in place to:

- a) Ensure design and installation of systems are carried out only by authorised agents;
- b) Maintain and make available a list of authorised agents;
- c) Ensure agents design, install and maintain systems in accordance with the manufacturer's requirements and take appropriate action if this is not carried out;
- d) Adequately train personnel. This training shall be carried out by a competent representative of the manufacturer and shall be refreshed at least every 5 years;
- e) Keep agents apprised of product updates and critical issues;
- f) Report and record failures in service;
- g) Ensure agents are capable of carrying out investigations and taking the necessary action after products in service are found to fail. The manufacturer may carry out this investigation and action; and
- h) Make regular checks of installations carried out by all agents. At least one new and one existing system shall be inspected per year chosen at random by the manufacturer.

LPCB will carry out the following before approval is issued:

- a) Audit that above procedures are being carried out. If LPCB do not audit all regional operations then the necessary information shall be available at the main site during audit;
- b) Check the fault reporting by agents; and
- c) Carry out selected product audit checks on an annual basis.

4 FIRE EXTINGUISHMENT TESTS

The fire extinguishment tests are drawn up according to the general principle that the test conditions shall be those which give rise to the most onerous extinguishing situations for the system. One of the tests investigates the possibility of system discharge causing burning fat to splash out of the cooking appliance.

As regards the choice of test cooking appliance, in order to minimise the number of fire tests, the deep fat fryer is selected to represent the range specified in the system manual. Depending on the system, LPCB reserve the right to require further fire extinguishment tests to cover a broader scope of application.

4.1 Test catering equipment

- 4.1.1 The catering equipment used for the tests shall comprise a deep fat fryer and extract system.

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4.1.2 The dimensions and arrangement of the catering equipment shall be based on the system manual, according to the following criteria:-

- a) The deep fat fryer pan shall have the maximum surface area that may be protected by one discharge nozzle.
- b) The deep fat fryer pan shall be marked with a maximum operating level which shall ensure an effective depth of cooking oil at least 150mm.
- c) The width of the extract hood shall be the maximum that may be protected by one discharge nozzle. The length shall be based on the number of discharge nozzles that are to be sited in it, so that the maximum linear spacing for the nozzles is achieved.
- d) The extract ductwork shall have the maximum perimeter or diameter that may be protected by one nozzle.
- e) The length and arrangement of the extract system shall be as shown in Figure 1.
- f) The deep fat fryer shall be placed directly beneath the entrance to the extract duct.
- g) The vertical separation between the top surface of the deep fat fryer and the lowest surface of the extract hood shall be not greater than 1 metre.

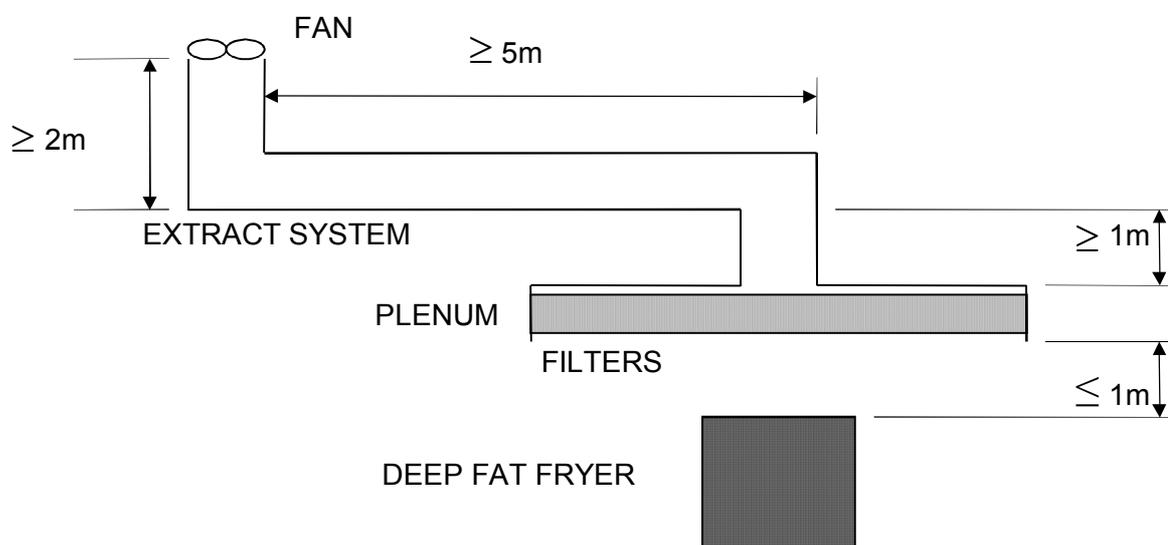


Figure 1. Schematic diagram of test catering equipment

4.1.3 Fish and chip frying ranges - This specialised type of catering equipment is rather different in nature from the types discussed above, notably because the extract system is often integral with the cooking appliance and orientated differently. For this reason tests appropriate to this hazard shall be defined and carried out.

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4.2 Test system designs

4.2.1 Minimum agent flow conditions tests

Shall be based on the system manual, according to the following criteria:-

- a) The system shall use the maximum number of discharge nozzles (or their equivalent in terms of agent discharge rate) for which it is designed.
- b) The deep fat fryer protection nozzle shall be sited at the maximum height above the surface of the cooking oil.
- c) The hood protection nozzles shall be sited at the maximum linear separation.
- d) The discharge nozzles which are not placed to protect the deep fat fryer, hood and ductwork shall discharge to waste simulating protection of other appliances under the hood.
- e) The manufacturer shall design the system such that the deep fat fryer protection nozzle is hydraulically the least favourable of the appliance protection nozzles. This shall be checked by the distribution test in Clause 5.1.
- f) The maximum length and minimum diameter of agent supply piping shall be used.
- g) The maximum number of branches and bends in the supply piping or the maximum equivalent length shall be used.
- h) For stored pressure/gas cartridge type systems the minimum storage pressure of expellant and minimum charge of agent shall be used.
- i) For pumped systems, the smallest diameter water supply pipe and minimum water supply pressure shall be used.
- j) For mechanical detection systems, the maximum length of line and maximum number of pulleys shall be used.

4.2.2 Maximum agent flow conditions test

Shall be based on the system manual, according to the following criteria:-

The system shall use the minimum number of discharge nozzles (or their equivalent in terms of agent discharge rate) that will protect the test catering equipment.

The deep fat fryer protection nozzle shall be sited at the minimum height above the surface of the cooking oil.

The minimum length and maximum diameter of agent supply piping shall be used.

The minimum number of branches and bends in the supply piping or the minimum equivalent length shall be used.

For stored pressure/gas cartridge type systems the maximum storage pressure of expellant and maximum charge of agent shall be used.

For pumped systems the maximum water supply pipe diameter with maximum water supply pressure shall be used.

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4.3 Instrumentation

Thermocouples shall be placed in the following positions on each test set-up:-

- a) In the pan of the deep fat fryer, 50 mm below the surface of the cooking oil.
- b) Centrally at the mid-point of the horizontal section of ductwork and at its exit.
- c) At the point where each detector is placed.

The thermocouples shall be monitored throughout the tests.

4.4 Test procedures

4.4.1 General

A total of four separate fire extinguishment tests shall be carried out.

Three tests shall employ the system designed to produce minimum agent flow conditions as described in Clause 4.2.1, the fourth shall employ the maximum agent flow system as described in Clause 4.2.2.

The first test shall be carried out with maximum air-flow conditions through the extract system i.e. with the extract fan operating and the filters removed from the hood.

The second test is also conducted with the extract fan in operation, but with the filters fitted to investigate their influence on the development and extinguishment of the fire.

For the third test, minimum air-flow conditions shall be achieved by having no forced ventilation and fitting the filters in the hood.

The fourth test, using the maximum agent flow system, shall be carried out with no forced ventilation in operation and with the hood filters removed. This test may yield the most onerous conditions from the aspect of system discharge causing splashing of the burning fat.

The test programme is expressed below in Table 1.

Test	Agent Flow	Extractor Fan	Filters
1	Minimum	On	Removed
2	Minimum	On	Fitted
3	Minimum	Off	Fitted
4	Maximum	Off	Removed

Table 1 – Fire test set-up

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4.4.2 Preparation

The arrangement shall be prepared for each test as follows:-

- a) Specified areas of the interior surfaces of the hood and ductwork, the discharge nozzles and detectors shall be coated with an average of 1.5 kg/m² of solid unused cooking fat. This may be applied by means of spraying the heated fat onto the surface of the component to be prepared.
- b) The filters when fitted shall be evenly loaded with an average of 3kg/m² of solid unused cooking fat, applied by means of spraying, dipping or spreading the fat onto each filter.
- c) The detection system shall be set up to operate as normal with the exception that it shall be prevented from actuating the system. Where more than one type of detection system may be used, each type shall be installed in at least one of the test systems.

4.4.3 Method

The fryer shall be filled with unused cooking oil to its maximum operating level.

The cooking oil shall be pure edible vegetable oil, with an auto ignition temperature range between 330 °C and 380 °C.

The heat source shall be applied to the cooking fat until auto-ignition occurs. The fire shall be allowed to develop with the heat source continuing to heat the fat.

The operation time of the detection system from auto-ignition shall be recorded.

30 seconds after the operation of the detection system the system shall be manually actuated. Upon system actuation, observations shall be made of the shut-down of the heat source and where it is required, shut-down of the extract fan.

For stored pressure/gas cartridge type systems the discharge time for the system shall be recorded. For pumped systems, the discharge time shall be in accordance with the time specified in the system manual requirements, LPCB reserve the right to assess the suitability of the actual discharge time.

4.5 Requirements

The following requirements shall be met in each test:-

- a) The fire shall be effectively extinguished within the system discharge time (as previously measured for stored pressure systems or as specified for pumped systems). One minute after the end of the agent discharge there shall be no residual flames burning in any part of the test catering equipment.
- b) At the end of the system discharge, the temperatures recorded throughout the equipment shall be lower than those taken at the time of system actuation and below auto-ignition temperature of the cooking fat used.

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- c) No re-ignition of the fire in the catering equipment shall occur after discharge of the agent. (To be checked for 10 mins after the end of agent discharge).
- d) No burning oil shall splash out of the cooking appliance as a result of agent discharge.
- e) Actuation of the system shall cause shut-down of the heat source.
- f) Where it is a requirement of the system, manual actuation of the system shall cause shut-down of the extract fan.

5 DISTRIBUTION TESTS

The distribution tests are intended to investigate agent distribution balance in extremes of system design.

5.1 Single container systems

The test shall be carried out on the two systems designed to produce minimum and maximum agent flow conditions as described in the fire extinguishment tests (Section 4). Each test may be conducted before a corresponding fire extinguishment test.

5.1.1 Procedure

A means of measuring and recording the agent discharge through each nozzle shall be set up. The system shall then be actuated by operation of a detector. The volume or weight of agent discharged through each nozzle shall be measured and recorded. The discharge time for the system shall be recorded.

5.1.2 Requirements

The agent distribution balance for both tests shall be in accordance with the system manual and in the case of the minimum agent flow system it shall be confirmed that the appliance protection nozzle is the least favourable, hydraulically, of the appliance protection nozzles.

5.2 Multi-container systems

Where a system may be designed to use more than one agent container, in addition to the distribution tests on the single container version of the system (as detailed in Clause 5.1) the following test shall be carried out.

5.2.1 Test system design

Shall be based on the system manual according to the following criteria:-

- a) In general, the system shall use two agent containers. However, where a system employs an expellant gas cartridge to pressurise more than one container, the largest cartridge shall be used with its maximum number of containers.

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- b) The arrangement of agent supply pipework and expellant pipework (where applicable) shall produce the most severe flow imbalance between nozzles supplied by different agent containers.

It is not required that the system be installed in an arrangement of catering equipment for the purposes of this test. Any suitable method of supporting and fixing the system pipework etc. in position will be acceptable.

5.2.2 Procedure

The system shall be charged normally. The means for measuring and recording the agent discharge through each nozzle shall be set-up. The system shall then be manually actuated. The discharge time for the system shall be recorded. The volume or weight of agent discharged through each nozzle shall be measured and recorded.

5.2.3 Requirements

The agent discharge through each nozzle shall be nominally equivalent to the results obtained for that nozzle in the distribution tests carried out on the single tank system.

5.3 Pumped systems

The test shall be carried out on the two systems designed to produce minimum and maximum agent flow conditions as described in the fire extinguishment tests (Section 4). Each test may be conducted before a corresponding fire extinguishment test.

5.3.1 Procedure

A means of measuring and recording the quantity of agent discharged through each nozzle shall be set up. The system shall then be actuated by operation of a detector. The volume or weight of agent discharged through each nozzle shall be measured and recorded for a period of discharge of 1 minute.

5.3.2 Requirements

The quantity of agent discharged through each nozzle for both minimum and maximum agent flow conditions shall be:

- for the minimum agent flow condition, it shall be confirmed that the quantity of agent flow through the appliance protection nozzle is equal to or less than the minimum flow specified for this nozzle in the system manual requirements.
- for the maximum agent flow condition, it shall be confirmed that the quantity of agent flow through the appliance protection nozzle is equal to or more than the maximum flow specified for this nozzle in the system manual requirements.

The actual rate of flow distribution, through each nozzle of the system, for both minimum and maximum agent flow conditions shall be in accordance with the system manual.

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6 COMPONENT EXAMINATION AND TESTS

Set out below are those test methods which are applicable in assessing the reliability and suitability for use of the major components in a system. Table 2 gives a general indication of the tests to which a particular component shall be subjected. However, the test programme required for a particular system will depend greatly on its design and method of operation as described in the system manual. The precise nature of the test programme shall therefore be decided by the LPCB in each case.

6.1 Examination

Components submitted for test shall be examined visually on the following points prior to test:-

- a) Finished assembly identification markings, pressure strength and fill ratio (where applicable) shall be recorded.
- b) Comparison of specimens with manufacturer's drawings for general form, completeness, capacities and designated markings.

6.2 Pressure strength tests

Components shall be tested to and conform to the requirements of BS EN 3-3 Clauses 6.1, 6.3, 9, 10.2 (burst pressure and test pressure only), 10.3, 12 as appropriate.

6.3 Leakage tests

Components shall be tested to and conform to the requirements of BS EN 3-2 Clause 3.

6.4 Corrosion Tests

For stored pressure/gas cartridge type systems components shall be tested to and conform to the applicable requirements of BS EN 3-7 Clause 14.

For BS EN 3-7 Clause 14.1 the applicable requirements are:

- after operation, the pressure gauge, if one is fitted, shall operate by subsequently indicating zero pressure.
- there shall be no corrosion of the metal of the system likely to impair its operation or safety.

For BS EN 3-7 Clause 14.2 the applicable requirements are:

- There shall be no visible signs of corrosion of the metal, nor detachment, cracking or bubbling of any protective coating of the body.

For pumped systems, components shall be tested to and conform to the Internal corrosion test requirements of BS EN 671-1;2001 clause 9.3 and the external corrosion test, BS EN 3-7 Clause 14.1.

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The system shall be subjected to flow tests before and after the internal corrosion test. The results of both flow tests shall be within $\pm 10\%$.
Following the external corrosion test, there shall be no corrosion of the metal of the system likely to impair its operation or safety.

6.5 Operation/Ageing Tests

6.5.1 Components shall operate satisfactorily before and after being subjected to the ageing test specified in Appendix A1.

6.5.2 When subjected to the tests specified in Appendix A2, detectors shall operate satisfactorily within design tolerances of their rated operating temperature and shall not show significant deterioration after being subjected to an ageing test.

6.6 Thermal Shock Test

Glass bulb detectors shall not be damaged when tested in accordance with Appendix B.

6.7 Clogging test

For pumped flow systems components shall be tested to the requirements of the Clogging test IMO 1165 clause 4.20. Flow tests shall be conducted before and after the Clogging test, the flow rates of the before and after tests shall be within $\pm 10\%$ of the first result.

6.8 Pump running test

For continuous flow systems, the pump shall be subjected to a continuous 10 hour running test. For this test the system shall discharge for the 10 hour duration, the water supply pressure shall be set to the minimum pressure specified in the system manual requirements.

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TABLE 2: COMPONENT TEST PROGRAMME

TESTS COMPONENT	EXAMINATION	PRESSURE STRENGTH	LEAKAGE	CORROSION	OPERATION/ AGEING	THERMAL SHOCK
AGENT CONTAINER	6.1	6.2	6.3	6.4		
CONTAINER VALVE (WHERE APP.)	6.1	6.2	6.3		6.5.1	
GAS CARTRIDGE (WHERE APP.)	6.1	6.2	6.3			
PRESSURE REGULATOR (WHERE APP.)	6.1	6.2			6.5.1	
PIPEWORK & JOINTS	6.1					
DISCHARGE NOZZLES & CAPS	6.1				6.5.1	
ACTUATING MECHANISM	6.1				6.5.1	
FUSIBLE LINK DETECTORS	6.1				6.5.2	
GLASS BULB DETECTORS	6.1				6.5.2	6.6
ELECTRICAL HEAT DETECTORS	6.1				6.5.2	
PUMPED SYSTEMS				6.4	6.5, 6.7, 6.8	

NB: Numbers in boxes refer to clauses in Section 6.

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7 MARKING, LABELLING AND PACKAGING

The manufacturer shall provide appropriate marking, labelling and packaging for the safe transport and subsequent use of the product as well as clear details of the manufacturer, their contact address, the product model identification and any other safety requirements. See section PN103 – Use of the BRE Global Certification Marks for further details of requirements for LPCB certification.

8 REFERENCES

Publication	Title
BS EN 3 : 1996	Portable Fire Extinguishers
BS EN 54-5 : 2001	Fire detection and fire alarm systems – Heat detectors – Point detectors.
PN103	Use of the BRE Global Certification Marks

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APPENDIX A: AGEING TESTS

A1 COMPONENTS USING NON-METALLIC MATERIALS

Expose components for a period of 90 days to an ambient air temperature of (130 ± 3) °C.

If a material cannot withstand the above temperature without excessive softening, distortion, or deterioration, a lower temperature for a longer period of time may be applied. The duration of exposure shall be calculated from:

$$D = 737000 e^{-0.0693t}$$

where: D is the test duration in days;
t is the test temperature in °C.

Note: This equation is based on the approximate 10°C rule; i.e. for every 10°C rise, the rate of chemical reaction is doubled.

A2 DETECTORS

Divide a batch of 10 fusible link or glass bulb detectors into two groups (a) and (b), each of five detectors. Expose the detectors in group (a) to an ambient air temperature which is 16°C below their rated operating temperature for a period of 90 days. Store the detectors in group (b) at 20 ± 5 °C for 90 days.

After ageing, operate the detectors by placing them in a wind tunnel, in general accordance with BS EN 54-5.

The operating temperature of the detectors in group (a), when measured, shall be within ± 15 °C of the results for the detectors in group (b).

APPENDIX B: THERMAL SHOCK TEST

Condition five glass bulb detectors of each nominal release temperature at 20 ± 5 °C for 24 hours. Stabilise the detectors at a temperature of 10 ± 2 °C below their nominal release temperature for at least 15 minutes. Then submerge the detectors, bulb seal downwards in water at a temperature of 10 ± 1 °C.

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Amendments Issued Since Publication

DOCUMENT NO.	AMENDMENT DETAILS	SIGNATURE	DATE
LPS 1223-1.0	Copyright change	CJA	30/07/02
LPS 1223-2.0	Changes to Front cover, participating organisations, foreword, Sections 3, 7 and layout	PJF	12/08/03
LPS 1223-2.1	Further copyright changes	CJA	22/09/05
LPS 1223-2.2	<ol style="list-style-type: none"> 1. Clauses added to allow for pumped systems in addition to stored pressure systems. 2. Minor alterations, following comments from EG B & C. 3. Clarifications about oil added. 	SNB	28/05/08
LPS 1223-2.3	<ol style="list-style-type: none"> 1. New front cover 2. Title added to header 3. Contents page moved to Page 1 4. Notes amended on Page 3 5. Further copyright changes 6. Repagination 	DC	Jan. 2014